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Enhanced Anti-Dermatophytic Effect of Nanoparticles Stimulated by Laser and Cold Plasma Techniques

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Abstract : Dermatophytosis is the infection of keratinized tissues such as hair, nail and the stratum corneum of the skin by dermatophytic fungi. Infection is generally cutaneous and restricted to the non-living cornified layers because of the inability of the fungi to penetrate the deeper tissues or organs of immunocompetent hosts. In Saudi Arabia, Onychomycosis is the most frequent infection (40.3%), followed by tinea capitis (21.9%), tinea pedis (16%), tinea cruris (15.1%), and tinea corporis (6.7%). Several azole compounds have been tried to control dermatophytic infection, however, the azole-containing medicines may interfere with the activity of hepatic microsomal enzymes, sex and thyroid hormones, and testosterone biosynthesis. In this research, antibody-conjugated nanoparticles stimulated by cold plasma and laser were evaluated in vitro against some dermatophytes isolated from the common types of tinea. Different types of nanomaterials were tested but silver nanoparticles (AgNPs) were proved to be most effective against the dermatophytes under test. The use of cold plasma coupled with antibody-conjugated nano-particles has severe impact on dermatophytes where the inhibition of growth, spore germination keratinase activity was more than 88% in the case of Trichophyton rubrum, T. violaceum, Microsprum canis and M. gypseum. Complete inhibition of growth for all dermatophytes was brought about by the interaction of conjugated nanoparticles, with cold plasma and laser treatment. The in vivo test with inoculated guinea pigs achieved promising results where the recovery from the infection reached 95% in the case of M. canis –inoculated pigs treated with AgNPs pretreated with cold plasma and laser.

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